High Capacity and High Voltage Composite Oxide Cathode for Li-ion Batteries, Phase I

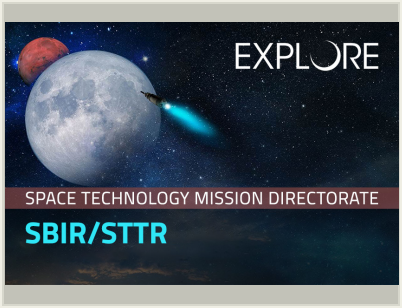
Completed Technology Project (2009 - 2010)

Project Introduction

NEI Corporation and University of Florida propose to develop a mixed metal oxide cathode that is a composite of two and three dimensional structures. At the atomic level, the crystal structure is expected to be both open (for fast Li-ion intercalation/diffusion) and stable (for good reversibility). The cathode materials developed in this program are expected to have high capacity and high rate capability, as well as long cycle life. Additionally, the crystal structure of the proposed material is expected to be stable over a wide temperature range upon Li-ion deintercalation, without oxygen evolution. This will allow the Li-ion cells to operate at high energy and power levels without compromising on safety. The target specific capacity of the proposed cathode is >200 mAh/g with a nominal working voltage of 4.8V, which gives out >960 Wh/kg specific energy. A unique feature of the proposed program is that it integrates theoretical and experimental work to enable a new generation of high capacity and high voltage cathode materials: the composition range and structure will be determined utilizing first principles calculation techniques developed by our STTR partner at University of Florida, and NEI Corp. will produce the cathode materials using its scalable and low cost process. The structure, composition, particle morphology and electrochemical performance will then be determined. The objective of the Phase I STTR program is to demonstrate the feasibility of a new high capacity and high voltage cathode material for rechargeable Li-ion batteries. In Phase II, the composition and morphology of the powders will be optimized, and integrated into large format prototype Li-ion batteries by working in partnership with a battery manufacturer(s). The objective will be to design and fabricate battery packs that meet the functional performance requirements set by NASA.

Anticipated Benefits

Currently available commercial Li-ion batteries do not adequately meet the requirements of electronic appliances, such as cell phones, laptop computers, power tools, sensors, and remote controllers. The cathode materials developed in this program will increase the overall performance of Li-ion batteries used in these applications. Others applications for the materials developed here include Electric vehicles (EV), hybrid electric vehicles, power backups, and alternative power generation, such as solar panels, wind turbines, which need batteries to store the generated energy. Currently, Li-ion batteries are utilized only for low-cycle life space applications, but reliable and safe Li-ion batteries with improved cycle and calendar life, high energy density and good low temperature performance are needed for astronaut equipment and solar powered landers, rovers, propulsion, and human outposts. With NEI's cathode materials, a high performance Li-ion battery will be produced to meet NASA requirements.



High Capacity and High Voltage Composite Oxide Cathode for Li-ion Batteries, Phase I

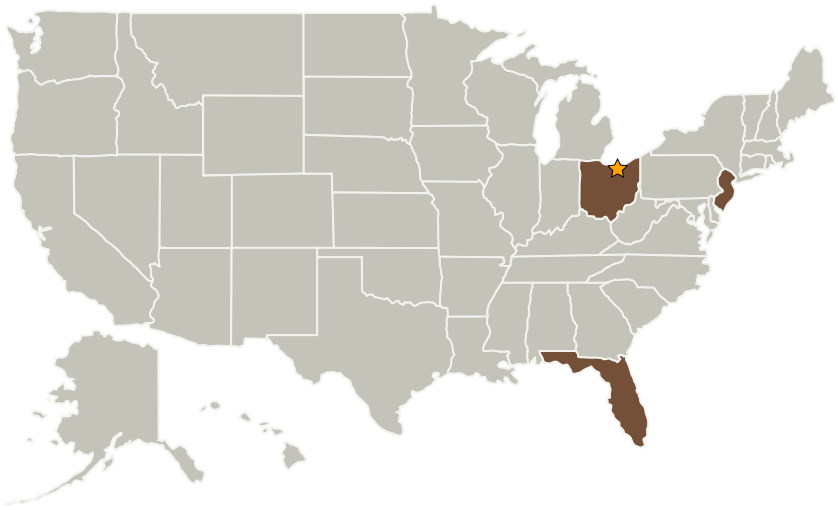
Table of Contents

Project Introduction 1
Anticipated Benefits 1
Primary U.S. Work Locations and Key Partners 2
Project Transitions 2
Organizational Responsibility 2
Project Management 2
Technology Maturity (TRL) 3
Technology Areas 3

High Capacity and High Voltage Composite Oxide Cathode for Li-ion Batteries, Phase I

Completed Technology Project (2009 - 2010)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
NEI Corporation	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Piscataway, New Jersey

Primary U.S. Work Locations	
Florida	New Jersey
Ohio	

Project Transitions

January 2009: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Concha M Reid

Principal Investigator:

Jinxiang Dai

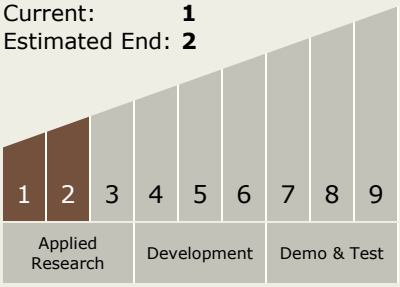
High Capacity and High Voltage Composite Oxide Cathode for Li-ion Batteries, Phase I

Completed Technology Project (2009 - 2010)

January 2010: Closed out

Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **2**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.2 Energy Storage
    - TX03.2.1 Electrochemical: Batteries